

PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

REC'D 17 OCT 2005

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(PCT Article 36 and Rule 70)

Applicant's or agent's file reference PC538DR	FOR FURTHER ACTION		See Form PCT/IPEA/416
International application No. PCT/EP2004/052954	International filing date (day/month/year) 12.11.2004	Priority date (day/month/year) 14.11.2003	

International Patent Classification (IPC) or national classification and IPC
B21D39/02

Applicant
OL-CI S.R.L. et al.

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
 - a. (*sent to the applicant and to the International Bureau*) a total of 9 sheets, as follows:
 - sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
 - sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
 - b. (*sent to the International Bureau only*) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).
4. This report contains indications relating to the following items:
 - Box No. I Basis of the opinion
 - Box No. II Priority
 - Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
 - Box No. IV Lack of unity of invention
 - Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
 - Box No. VI Certain documents cited
 - Box No. VII Certain defects in the international application
 - Box No. VIII Certain observations on the international application

Date of submission of the demand 14.09.2005	Date of completion of this report 18.10.2005
Name and mailing address of the international preliminary examining authority:  European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized Officer Ris, M Telephone No. +31 70 340-2363



INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/EP2004/052954

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
 - This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
 - international search (under Rules 12.3 and 23.1(b))
 - publication of the international application (under Rule 12.4)
 - international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements*** of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):

Description, Pages

1, 4, 5, 7-12, 14-17	as originally filed
2, 3, 3a, 6, 13	received on 15.09.2005 with letter of 14.09.2005

Claims, Numbers

1-15	received on 15.09.2005 with letter of 14.09.2005
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Drawings, Sheets

1/23-23/23	as originally filed
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- a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. The amendments have resulted in the cancellation of:
 - the description, pages
 - the claims, Nos. 16-20
 - the drawings, sheets/figs
 - the sequence listing (*specify*):
 - any table(s) related to sequence listing (*specify*):
4. This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
 - the description, pages
 - the claims, Nos.
 - the drawings, sheets/figs
 - the sequence listing (*specify*):
 - any table(s) related to sequence listing (*specify*):

* If item 4 applies, some or all of these sheets may be marked "superseded."

**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/EP2004/052954

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-15
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-15
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-15
	No:	Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

**INTERNATIONAL PRELIMINARY
REPORT ON PATENTABILITY
(SEPARATE SHEET)**

International application No.

PCT/EP2004/052954

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

- 1 The applicant has modified claim 1 such that the feature, that the cam member is mounted on the movable unit, is no longer present.

This feature is indispensable as such for the function of the invention in the light of the technical problem which it seeks to solve.

The deletion of this feature introduces thus subject-matter which extends beyond the content of the application as filed, contrary to Article 19(2)/Article 34(2)(b) PCT.

The opinion on novelty and inventive step has been established as if the feature, that the cam member is mounted on the movable unit, is included in claim 1.

- 2 In the machine disclosed in EP-A-933148 (D1) the cam member does not cooperate with an engagement surface provided by the workpiece-carrying structure, but with an engagement surface provided by the tool-carrying unit.

According to EP-A-642854 (D2), both the engagement surfaces cooperating with the two cam members 12 and 14 are the cylindrical surfaces of the two rollers 28 and 30, which are both carried by the tool-carrying unit.

Since neither D1 nor D2 show the characterizing feature of providing the engagement surface on the workpiece-carrying structure, independent claim 1 is novel over the cited documents.

As claims 2-15 are dependent on claim 1, the subject-matter of these claims is new as well.

- 3 Claim 1 should also be considered inventive over the cited documents, in view of the following reasons.

Starting from D1, which is considered to represent the closest prior art as it shows all the features set forth in the preamble of claim 1, the technical problem underlying the invention is to provide a more reliable, precise and cost-effective machine with respect to the prior art.

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According to the invention, this problem is solved by configuring the mechanism for converting the rotational motion of the driving shaft into the translational motion of the tool-carrying unit in such a manner that the cam member driven by the driving shaft cooperates during the working stroke with a surface provided by the workpiece-carrying structure. By virtue of this configuration, the force applied by the tool on the workpiece, and therefore on the workpiece-carrying structure, during the working stroke, which force is directed downwards in the preferred embodiment shown in the drawings, is counterbalanced by the contact force between the cam member and the engagement surface provided by the workpiece-carrying structure, which force is directed upwards.

In other words, the reaction force exerted by the workpiece on the tool-carrying structure is counterbalanced by the reaction force exerted by the engagement surface on the cam member. Since these reaction forces, which both act on the movable unit, are balanced during the working phase, no reaction forces are transmitted by the movable unit to the stationary base. The only force the movable unit transmits to the stationary base is its weight. This means an extraordinarily great reduction in the loads acting on the stationary base, by virtue of which the machine has a longer life, ensures a higher working precision over its life and requires less servicing than the prior art.

The above solution is neither shown nor suggested by any of the cited documents in the search report. Therefore, starting from D1, the person skilled in the art would not have found in the state of the art any hint leading him to modify the machine of D1 in order to arrive at the claimed invention.

The subject-matter of claim 1 should therefore be regarded as involving an inventive step.

As claims 2-15 are dependent on claim 1, the subject-matter of these claims involves an inventive step as well.

For the sake of simplicity, it will be assumed hereinafter that the two flat edge portions 3 and 4 of the panels to be flanged are arranged in a horizontal plane and therefore that the direction along which the flanging forces are applied is vertical. The terms "horizontal" and "vertical" are thus to be understood, in the description and the claims which follow, as parallel to the plane on which the edge portions of the panels to be flanged lie and as perpendicular to that plane.

The flanging operation described above is commonly performed with the use of a tool-carrying unit 10 of the same type as that schematically shown in Figure 2. The tool-carrying unit 10 is mounted on the flanging machine (not shown) so that it can be moved vertically to perform the pre-flanging and the final-flanging operations, as well as moved substantially horizontally towards or away from the working area in order, for example, to allow the workpiece to be loaded or unloaded.

The unit 10 carries a first, pre-flanging tool 11 having a working surface 11a inclined at the pre-flanging angle (typically 45 degrees) with respect to the vertical direction, and a second, final-flanging tool 12 having a working surface 12a inclined at 90 degrees with respect to the vertical direction.

of the above-mentioned type

A flanging machine ~~according to the preamble of independent Claim 1~~ is known, for example, from European patent application EP 0 924 005. According to this known solution, the vertical movement of the tool-carrying unit is driven by a screw mechanism controlled by an electric motor, whereas the movement towards and away from the working area (in this case, a tilting movement) is driven by a leverage controlled

by a pneumatic cylinder.

The use of a screw mechanism for driving the vertical movement (working movement) of the flanging machine has first of all the disadvantage of a high cost, due both to the high precision required for the production of the screw and to the complexity of the electronic control system required to ensure the correct operation of the machine. Moreover, the precision of the machine, and hence the quality of the worked pieces, may tend to decrease with time as a result of the plays due to the wear of the screw mechanism.

<insert page 3a>

It is therefore the object of the present invention to overcome the shortcomings of the prior art discussed above, by providing a machine for working sheet metal parts, in particular for performing flanging operations, which has a simple structure, a low cost and a precise and reliable operation with time.

This and other objects are achieved according to the invention by virtue of a machine having the characteristics defined in the characterizing portion of independent Claim 1. Further advantageous characteristics of the invention are defined in the dependent claims.

A further independent Claim 15 relates to a driving system for a machine for working sheet metal parts, particularly for carrying out flanging operations.

The advantages of a machine according to the invention with respect to the prior art can be summarized in the following points:

- simpler construction,

3a

German utility model DE 295 11 071 U discloses a driving system for driving a tool-carrying unit of a machine for the working of sheet metal parts, in particular a bending or punching machine, wherein the tool-carrying unit is slidably mounted along a vertical direction on a supporting structure of the machine. This known driving system comprises a driving shaft rotatably mounted on the supporting structure and carrying two cam discs engaging with two rollers mounted on the tool-carrying unit. The one cam disc and roller assembly controls the working stroke of the tool-carrying unit, while the other cam disc and roller assembly controls the return stroke of the tool-carrying unit.

A flanging machine according to the preamble of independent Claim 1 is known from European patent application EP-A-0 933 148. In this case, the vertical reciprocating motion of the tool-carrying unit is driven by an electric motor which is fixedly mounted on a supporting structure of the machine and operates a driving shaft rotatably mounted on the supporting structure and connected to the tool-carrying unit by means of a cam and lever mechanism.

flanging machine according to the invention at respective characteristic points of the work-cycle illustrated in Figures 12A to 12K.

3

Referring first to Figures ~~1~~ to 10, a flanging machine according to the invention, generally indicated 20, comprises:

a stationary base 22, intended to be fixed to the floor or mounted on a proper support plane (not illustrated) arranged parallel to the plane in which the edge portions of the sheet metal panels to be connected by flanging lie;

a movable base 24, mounted on the stationary base 22 so as to be movable parallel to the latter towards or away from the working area (double arrow X), hereinafter indicated as longitudinal direction;

a main body 26 fixed to the movable base 24 and having substantially a portal-like structure;

a movable unit 28, mounted on the main body 26 so as to be movable vertically (double arrow Z), that is, perpendicularly to the plane of the two bases 22, 24; and

a tool-carrying unit 10 of the same type as that described above with reference to Figure 2, which is fixed onto the movable unit 28.

In order to guide the translational movement of the movable base 24 along the direction X, the base is provided with a pair of longitudinal rails 30 (one of which can be partially seen in the sectional view of Figure 6) arranged to slide on respective guide surfaces 32a provided by two pairs of slid-

with its tool 11, while the cam 76 disengages from the lower roller 78 and starts to engage with the upper roller 86, drivingly connected to the workpiece-carrying structure 88, starting approximately from a point P_{C1}^* opposite point P_{C1} or from a following adjacent point. This second step provides for a rotation through nearly 60 degrees, until the cam 76 comes into contact with the upper roller 86 in a point P_{C2} . Since the outline segment comprised between points P_{C1}^* and P_{C2} is an arc of circumference, no vertical movements of the movable unit 28 take place during this second step.

As the cam 76 continues to be rotated, it engages with the upper roller 86 along the outline segment 76a comprised between point P_{C2} and a point P_{C3} and finally reaches the position shown in Figure 14. Since this outline segment provides for an increase in the radial distance from the centre of rotation O, the cam 76 is urged downwards dragging with it the movable unit 28 and the tool-carrying unit 10 mounted thereon. The pre-flanging tool 11 can thus perform the pre-flanging operation, by exerting on the edge 3a of the panel 1 a bending force which is the sum of the weight of the movable unit 28 and of the downward load brought about by the interaction of the cam 76 with the upper roller 86.

In a fourth phase, the movable unit 28 is moved vertically upwards until it returns into the "pre-flanging start" position. To this end, the cam 76 is caused to rotate clockwise until it returns into the initial position shown in Figure 13, in which it contacts the lower roller 78 in point P_{AB} .

In a fifth phase, the movable unit 28 is moved longitudinally until it reaches the "loading/unloading" position illustrated in Figure 12E, while the ~~cam~~ 76 is held stationary in the

CLAIMS

1. A machine (20) for the working of sheet metal parts (1, 2), comprising

a tool-carrying unit (10; 11, 12);
a workpiece-carrying structure (88);
a supporting structure (24, 26);
a movable unit (28) which carries the tool-carrying unit (10; 11, 12) and is slidably mounted on the supporting structure (24, 26) along a first direction (Z), or working direction; and

a first driving system for controlling the movement of the movable unit (28) in the first direction (Z), the first driving system including a first driving shaft (62), a first motor unit (60) for controlling the rotation of the first driving shaft (62) and a mechanism for converting the rotational movement of the first driving shaft (62) into the translational movement of the movable unit (28), wherein the said mechanism comprises a first cam member (76) driven by the driving shaft (62) and a first engagement surface (86) arranged to co-operate with an outline (76a) of the first cam member (76) to bring about a first working movement of the movable unit (28);

characterized in that the first engagement surface (86) is provided by the workpiece-carrying structure (88).

2. A machine according to Claim 1, wherein the first engagement surface (86) is provided on an opposite side of the workpiece-carrying structure (88) to the one on which the metal parts (1, 2) to be worked are arranged.

3. A machine according to Claim 1 or Claim 2, wherein the first engagement surface is a cylindrical surface provided by

a first roller member (86) rotatably mounted on the work-piece-carrying structure (88).

4. A machine according to any of the preceding claims, wherein the cam member (76) is carried by the movable unit (28).

5. A machine according to Claim 4, wherein the first driving shaft (62) is carried by the movable unit (28) and the cam member (76) is mounted on the first driving shaft (62).

6. A machine according to Claim 5, wherein the first motor unit (60) is also carried by the movable unit (28).

7. A machine according to any of the preceding claims, wherein the mechanism for converting the rotational movement of the shaft (62) into the translational movement of the movable unit (28) further comprises a second engagement surface (78) arranged to co-operate with the outline (76a) of the first cam member (76) to bring about a return movement of the movable unit (28).

8. A machine according to Claim 7, wherein the second engagement surface (78) is on an opposite side of the first cam member (76) to the first engagement surface (86).

9. A machine according to Claim 7 or Claim 8, wherein the second engagement surface is a cylindrical surface provided by a second roller member (78) rotatably mounted on the supporting structure (24, 26).

10. A machine according to Claim 9 when dependent on Claim 3, wherein the axes of rotation of the first cam member (76),

of the first roller member (86) and of the second roller member (78) are substantially aligned along the first direction (Z).

11. A machine according to any of the preceding claims, wherein the mechanism for converting the rotational movement of the first shaft (62) into the translational movement of the movable unit (28) further comprises a second cam member (72) driven by the first driving shaft (62) and a third engagement surface (90) arranged to co-operate with the second cam member (72) to bring about a second working movement of the movable unit (28).

12. A machine according to Claim 11, wherein the direction of the said first working movement of the movable unit (28) is the same as that of the said second working movement.

13. A machine according to Claim 12,

wherein the tool-carrying unit (10; 11, 12) carries a first pre-flanging tool (11) and a second final-flanging tool (12) in such a manner that the machine is adapted to perform a flanging operation in a first pre-flanging phase and in a second final-flanging phase, and

the first driving system is configured in such a manner to drive the said first working movement of the movable unit (28) to perform the pre-flanging phase and the said second working movement of the movable unit (28) to perform the final-flanging phase.

14. A machine according to any of the preceding claims, further comprising a stationary base (22), wherein the supporting structure (24, 26) is slidably mounted on the stationary base (22) along a second direction (X), substantially perpen-

dicular to the first direction (Z), in such a manner that the movable unit (28) can be moved towards and away from the workpiece-carrying structure (88).

15. A machine according to Claim 14, further comprising a second driving system for controlling the movement of the movable unit (28) along the second direction (X), wherein the said second driving system includes a second motor unit (34) and a crank mechanism (36) for converting the rotational movement outputted by the second motor unit (34) into the translational movement of the movable unit (28) along the second direction (X).